U.S. Department of Agriculture
Office of the Secretary

THE FUTURE OF LIMESTONE IN AGRICULTURE

It is appropriate that the first National Aglime Conference be held in the first year of the decade of the 1980's. If the 1970's were the years of oil, the 1980's definitely can be the years of agriculture.

And, unlike oil, agriculture is an area where we are the leaders -- and in these years and in this leadership, limestone, your product, can play a significant role, a role that not only will fill a moral need by bringing food to the hungry but will also enhance the stature of this nation as well as mean profits to you.

What is at stake for agriculture?

Let's look at some of the figures. America's population of considerably more than 200 million people is fed by only the 1.6 percent of them who work on the farms. That indicates a system which, overall, has to be considered highly efficient.

But that's only the beginning.

Exports of farm products will reach 162 million tons, a total of $40 billion, this year. In the balance of payments, the agriculture surplus is about $22 billion. With that surplus, we buy products we need from abroad or help counter the deficit caused by the soaring price of oil.

For the future, the 1980's, the figures look better. That $40 billion I mentioned a moment ago is $8 billion more than the previous year, and the prospects are that it will continue upward. In our trade we deal with many nations which do not yet have the expertise to go much beyond subsistence farming. These nations wish to industrialize, to modernize. But for them to take people from the farms and send them to schools, to train them, to have them work in factories and in the cities means that these nations must buy food from us.

Definitely then agriculture is a growth industry. And the members of the limestone industry should be part of this growth.

Why is limestone so necessary?

Remarks by Dr. Anson R. Bertrand, Director, Science and Education, U.S. Department of Agriculture, before the National Aglime Conference, Nashville, Tenn., October 16, 1980, 1:30 p.m. EDT

Like other growth industries, agriculture has its problems. The productivity of the land must not only be maintained but also increased, and that must be done against the realization that our resources are not infinite.

In this country we have serious problems of soil erosion. In some corn belt fields, for example, we lose five bushels of topsoil for every bushel of corn we produce. Nationwide, for each acre farmed every year, we lose an average of nine tons of topsoil.

We also have problems with soaring fertilizer costs due to the petroleum requirements for fertilizer manufacture, and also with the growing acidity in our soils -- just to list a few.

Limestone and the greater reliance upon biological nitrogen fixation can do much to counter these problems.

Right now, you are probably thinking, "We are already in the agriculture business. What's wrong with Bertrand?"

Well, the involvement of the limestone industry in agriculture, ladies and gentlemen, right now is only scratching the surface.

Recent statistics, for example, show a need for limestone for agriculture purposes of 95 million tons a year but of only 31 million tons actually used.

Here are some specific examples. In Georgia, 1.3 million tons of limestone were used; another million tons were needed. In Indiana, three million tons were needed over what was used. And in Texas only 240,000 tons were used; the measured need was more than ten times that.

Pennsylvania is an interesting State in terms of lime usage and need. Data from 300,000 soil samples were collected for a six-year period. The material collected definitely pointed to an increased need for limestone. Still, despite that data, despite its conclusiveness, the State still was using only one-third of the limestone it needed.

Those overall figures I mentioned a few moments ago, 95 million tons needed but only 31 million tons used, mean that you are selling only one ton of limestone to farmers for every three tons the farmers need.

Even those figures are deceptive. Those 31 million tons sold nationally represent only 4.2 percent of all limestone used in the United States in 1978. Simple arithmetic indicates that if limestone had really hit its market, agriculture usage would have amounted to 12.6 percent of all limestone manufactured.

But those figures are, as I said, deceptive because that's only the beginning. Those need figures -- those 95 million tons -- are based on the state of the art as it existed in the 1970's. In the 1980's the state of the art is going to advance. We're going to know more about the need and use of limestone in agriculture. That means the prospect for limestone in agriculture can be far greater than that current 12.6 percent.

And that need for more limestone in agriculture comes at a time when the prospect for limestone in its principal use, highway construction, is dimming. Because of a downturn in the use of automobiles due to OPEC and because of a tightening of expenditures at all levels of government, highway construction is anticipated to level off, at least.

Let's be blunt. That means you must exploit new markets.

The agriculture market is waiting to be developed.

How does limestone affect agriculture?

It does this in several ways.

Liming -- that is, adding lime to the soil -- can increase crop production by enhancing the availability of the essential plant nutrients and by improving soil structure. In an Arkansas program, adding four tons of limestone to an acre increased the soybean production from 22 to 30 bushels. In a program in Kansas, lime combined with a varied fertilizer program and a crop rotation program increased the production of wheat from 25 to 68 bushels per acre.

Although those figures are as good as they sound, they are not startling to persons with backgrounds in agriculture. That lime enhances farm productivity has been known for thousands of years. In this country, Benjamin Franklin was one of the first great advocates of liming.

Liming's positive effects come from its neutralizing of soil acidity. Soil acidity, although always a problem in the United States, has become an increasing challenge in recent years and presents, therefore, an increased opportunity for the limestone industry.

As you know, the degree of acidity in soil is referred to by the term "pH" and is measured on a scale of one to 14. A pH of one indicates the highest degree of acidity; seven is neutral, and 14 would indicate a highly alkaline condition.

Crops grow best with the pH level between the range of 5.5 and 7.0, although the optimum level varies for each crop. For wheat and corn that 5.5 to 7.0 range is preferable while for alfalfa, the desired range is 6.2 to 8.0.

Soil acidity is caused naturally in humid areas by precipitation percolating through the soil carrying dissolved basic nutrients below the area where the plant roots exist. Other causes are the nature of the material from which the soil is formed; some are naturally more acidic. The use of nitrogen fertilizer increases a soil's acidity. Actually, the very process of growing crops can increase a soil's acidity by removing basic nutrients.

Those causes continue, of course, but in more recent years there has been recognized a new cause. This is the development of acid rain, the depositing of acidity on the earth through precipitation.

President Carter described the seriousness of this development a year ago in his environmental message to Congress. He said:

> Acid rain has caused serious environmental damage in many parts of the world including Scandinavia, Northern Europe, Japan, Canada and the Northeastern part of the United States. Over the past 25 years the acidity of rainfall has increased as much as fifty-fold in parts of the eastern half of the United States. In the Adirondacks in New York, many mountain lakes have become devoid of fish partly because of increasing acidification. Adverse effects on crops and forests are suspected; steel and stone buildings and art works may suffer as well.

Although acid rain always has been with us, there has been, it is believed, a substantial increase in recent years because of the increase in the combustion of fossil fuels with the resultant release of sulphur dioxide into the atmosphere. Again because of OPEC, we are going more and more to the burning of coal with even greater sulphur content. That means the acid rain problem is going to be with us more, not less, in the coming years.

Already we know that acid rain in North America, once primarily a problem for the eastern part of the United States, has spread to the south, west, and north. And what is happening in the United States is also happening throughout the world.

In Scandinavia about 10,000 lakes now are devoid of fish and another 10,000 lakes are threatened by acid rain. In this country the aquatic effects of acid rain have not been documented as comprehensively as in other nations. Still, there is no doubt that lakes in the Adirondack Mountains and in the upper Midwest are showing results in the destruction of fish from increased acidity.

Sudden surges of acidity -- when a winter's snow melts and carries residual acidity into waterways, for example -- are the most harmful to the fish.

Acid rain can have a number of adverse effects on soil. Laboratory studies point to direct damage to plant leaves and roots, to interference with the biological fixation of nitrogen, and to predisposing plants to injury by diseases, insects, or other environmental stresses.

Other avenues of research must be followed -- especially we want to know whether soils can be degraded or impoverished irreversibly as a result of acid rain.

As you can see, there is a problem, and you hold an important answer. But more is required of you than only to grind limestone. Your product must be tailored to the needs of the farmer and the manager of water resources.

What we are talking about then is research. As I indicated before, we now are only scratching the surface of the agriculture needs for limestone. To get below the surface we must take a scientific approach.

Here are some specifics.

Generally, lime treatment of the soil has been on the top soil. Would the insertion of lime in the subsoil of a particular acidic area increase cotton output? In Alabama, Experiment Station scientists injected lime into acid soils at depths of zero to six, to 12, and to 18 inches and compared them to an area where lime had not been injected.

The more lime, the greater the cotton production. Yields of seed cotton ranged from 805 pounds per acre where there had been no lime to 2,311 pounds where the lime had been mixed to a depth of 18 inches. Plant heights also increased with the greater use of lime, ranging from 19 inches in the no-lime area to 50 inches in the area where lime had been used to the 18-inch depth.

In another Alabama experiment, researchers dealt with reduction of both soybean and vegetable yields in highly acid soils. The response to lime, after the first year of cropping, was greater for soybeans than the other crops. As I said before, we must tailor the soil management to specific needs and scientific research is the way to learn those needs.

To underscore that point, one research project involved applying lime to a number of different soil samples and then measuring plant growth. Depending on the soil, plant growth -- with recommended lime applications, gave responses varying from 14 to 197 percent. But plant growth was less in those samples with double the recommended rate. This indicates the possibility of overliming and the importance of diagnostic soil tests.

Another increasing use of lime, as shown by research, involves revegetating acidic strip mine soils. Using rock phosphate and dolomitic limestone as soil additions, a greatly improved plant cover with forage grasses and legumes provides both stabilization and quality forage.

That quick review of some of the Department's sponsored research projects was not intended as a summary of the state of the art. Rather, it was to suggest to you some of the areas now being explored. Liming has been shown to be essential to energy-efficient rotations in which legumes are playing a larger role today. These rotations are increasingly used on acid soils throughout the humid regions of the United States in response to the higher cost of fertilizer nitrogen today.

Soil's lime requirements vary -- by geography, by crops, and sometimes by time. For the future we must develop a research system capable of pinpointing exact needs. We must understand how lime interacts with the nutrients in the soil to enhance the result.

Regulating soil acidity with lime controls some crop diseases, such as potato scab; this is an area obviously in need of much greater research. A drought one year can change the need for lime in the soil, something we must learn to understand.

In the past, research has been primarily with the effect of lime on the top soil. We must do more research on lime in the subsoil. Such research should be integrated with the general research now being done on the subsoil.

An important area of research is the effect of lime on aluminum and manganese toxic effects. The aluminum can be responsible for the inhibition of root development and toxic manganese can also be in excess in acid soils. Lime counters both those undesirable conditions.

Another area is the enhancing effect of lime on fertilizers. As the costs of fertilizer soar, if the amounts needed can be decreased -- because of an application of lime -- then the economic impact can be significant. Not only would it mean increased sales for you but also greater profits for the farmer and more sales for the United States abroad.

The significant areas of research before us can be determined by examining the list of topics for discussion tomorrow morning. The topics have to do with soil testing, determining an effective liming material, increasing the effectiveness of liming materials; and the effects of liming on pesticide efficiency, crop yields, quality, and profits.

But more than any specific research challenge, more than any actual soil need, the challenge is to think in terms of research and science. The agronomist's test tube must be placed on an equal basis with the engineer's slide rule.

Also, you must speak out on the need for greater research in the soil as you spoke out on the need for greater research in highway design and construction; you must speak out for Federal, State, and local support.

We need spokespersons for the kind of research that transcends the limits of any particular commodity but deals with soil improvement as it affects the future of agriculture as an entity.

Another area where a challenge lies ahead for you is in your meeting with the farmer. Transporting the lime to his or her farm can be a critical problem, especially in those areas where there is a limestone shortage. Somehow you must conquer that problem -- anticipate needs, investigate shipping and application systems, establish marketing outlets -- and bring the product to the farmer who has the need for that product.

You will come in contact with the members of the Cooperative Extension Service. You must learn to talk to them in their language -- the language of the soil, of acidity, and of nutrients; the language of crop yields and of profits to the farmers.

But most of all you must learn to confront old attitudes about limestone. Agriculture limestone is not a sideline, an item marketed as an after-thought, as it has so often been in the past -- or, at least, it should not be. Your marketing must be aggressive and your distribution comprehensive.

Let us remember that agriculture is basic. We can survive without television sets, even with a reduced supply of oil; but we cannot survive without food. Nor can our greatness as a nation continue without food surpluses.

Let us also remember that because we have achieved in the past in agriculture, we cannot assume that we will so achieve in the future. We will do that only if we adapt to our new problems. The history of the world is spotted with the accounts of many great nations and empires which once led the world but dropped into insignificance and poverty, primarily because their ability to produce food declined.

To use an old business metaphor, you are in on the ground floor of a great opportunity. You have a product that is going to be needed increasingly in agriculture. By taking advantage of that opportunity, you will help assure that the world's hungry will be fed, that your nation will remain strong -- while also benefiting yourselves.

Not often do we have such a choice.

Thank you.